Space Weather Technical Forecast

Issued on Friday, 07 April 2023 at 12:31 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of M-class flares (R1-R2; Minor-Moderate radio blackouts) throughout. Active electron fluence on Day 1 (07 Apr).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low, with the largest flare a C3.9 event at 06/1400 UTC from AR3270 in the far southwest. Overall there are three sunspot regions on the visible disc, with AR3272 in the far southeast the largest of these, having recently rotated over the eastern limb. The region is fairly large with a number of small intermediate spots and is classified as a Esi/Beta group. AR3270 has decayed somewhat, with the prior delta spot having faded, as well as the intermediate spots. The region is now an Eso/Beta group. The remaining region (AR3266) is a small, magnetically simple area (Bxo/Beta) in the far northwest. The previously unnumbered region around S26E19 has faded.

Around 07/0800 UTC a modest-sized filament lifted off from an area around S35W00. Although the liftoff does not appear particularly energetic, there may be an Earth-directed component given its location along the Earth-Sun meridian. We await further coronagraph imagery in order to assess if the associated CME may become geo-effective. No other Earth directed CMEs have been observed in available imagery.
Solar Wind / Geomagnetic Activity: The solar wind as observed by DSCOVR at L1 was initially at ambient Background levels (around 380km/s) but increased to Slightly Elevated levels from around 06/1930 UTC. Winds have remained around 400-420km/s since then. Density has mainly been at Below Average levels, with only brief increases to Average during the period. Magnetic field strength, Bt, has been Weak throughout, below 8 nT, with the north-south component, Bz, also varying weakly between +/-6 nT. The Phi angle has been mostly negative (towards the Sun). Geomagnetic activity has been Quiet to Unsettled (Kp1-3).

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV), as measured at GOES16, has been at Background levels. The high energy electron flux (greater than 2MeV), as measured at GOES16, was at High levels at first and at the diurnal maximum reached a peak of 4250pfu at 06/1720 UTC. Since then, electron flux has steadily declined, returning to Moderate levels from 06/2320 UTC and then Background from 07/0250 UTC until around 07/1000 UTC, after which mainly Moderate levels were observed again. Electron fluence has been at Active levels during the period, with an increasing, then decreasing trend. 1.29e8 integrated pfu fluence was recorded at 07/0001 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is most likely to be Low, but with a chance of Moderate activity, most likely from either AR3272 in the southeast, or AR3270 in the northwest. Other regions may emerge across the northeastern limb during the period to potentially supplement the existing flare risk.

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Met Office Space Weather Technical Forecast

Solar Wind / Geomagnetic Activity: A filament eruption around 0800 UTC on 07 Apr from approximately S35W00 is awaiting coronagraph imagery to determine if there is an Earth-directed component. Otherwise, there are no Earth-directed CMEs expected. Wind speeds are likely to mainly be at slow-ambient levels during the period, but could increase to Slightly Elevated levels on Day 4 (10 Apr), given the anticipated connection to a coronal hole HSS.

Geomagnetic activity is expected to mainly be Quiet to Unsettled, with a slight chance of Active periods or G1/Minor Storm intervals on Day 4.

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV) is at background levels and is likely to remain so, in the absence of significant flare activity. Electron flux values are likely to continue to show a diurnal cycle between Background and Moderate to High levels. Following a period of more active electron flux and fluence, a more steady-state condition is anticipated in the coming days. Active (greater than 1e8 integrated pfu) electron fluence is expected to cease on Day 1 and remain below the threshold for the remainder of the forecast period.

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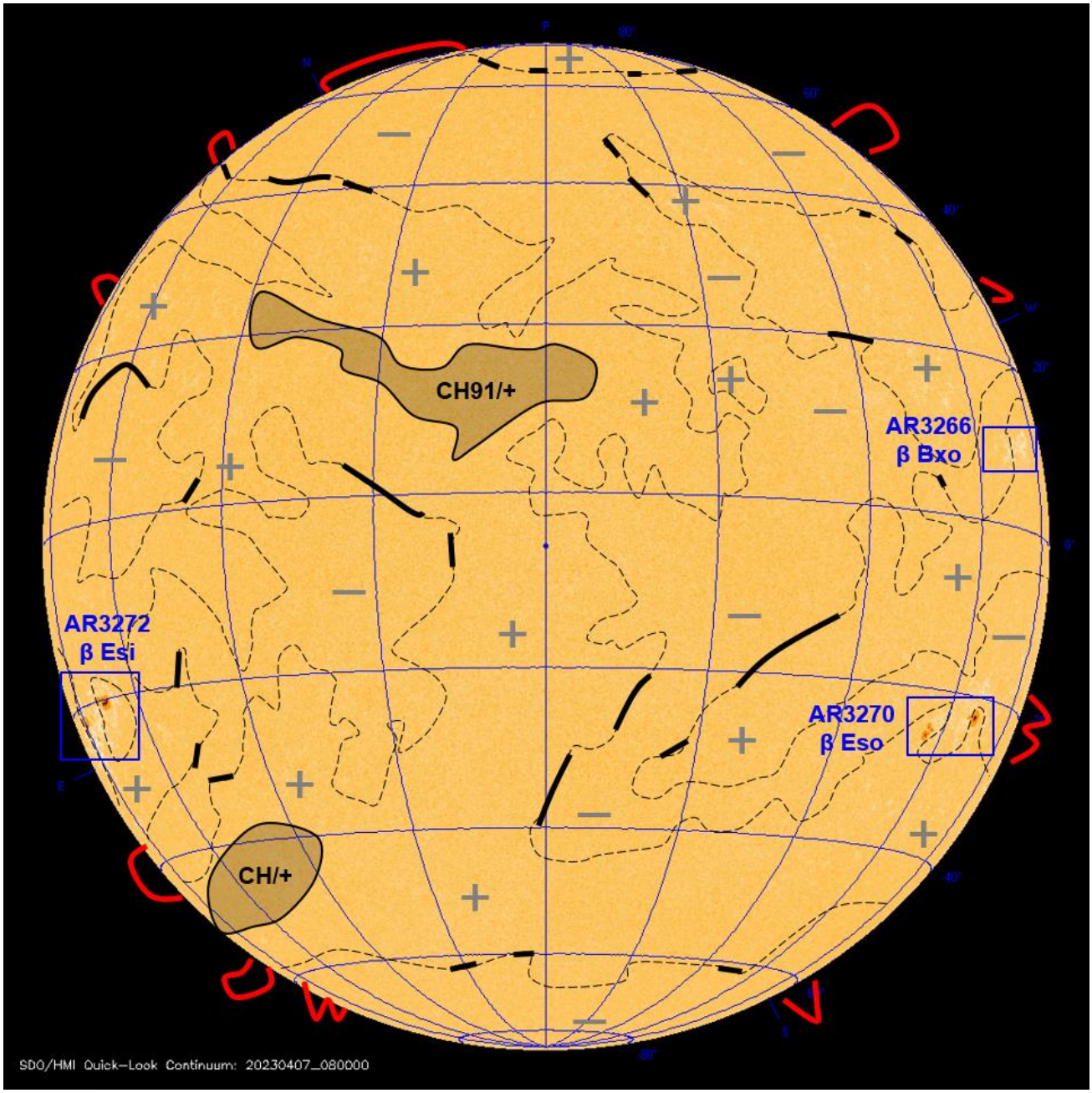
Figure 1. Solar Analysis Valid 07/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

Around 07/0800 UTC a modest-sized filament lifted off from an area around S35W00. Although the liftoff does not appear particularly energetic, there may be an Earth-directed component given its location along the Earth-Sun meridian. We await further coronagraph imagery in order to assess if the associated CME may become geo-effective. No other Earth directed CMEs have been observed in available imagery.

The recent HSS from either coronal holes 89 or 90 has now faded, with wind speeds fluctuating between Background and Slightly Elevated levels. In the absence of any CMEs, wind speeds are expected to return to slow-ambient levels for much of, if not all of the Day 1-3 (07-09 Apr) period.

A high-speed stream (HSS) from CH91/+ may begin to influence the solar wind regime as early as Day 4 (10 Apr), however, could commence on 11 Apr. The leading edge of the coronal hole appears to be a little further ahead on this rotation compared to the last, favoring an arrival time on Day 4. Recurrence of this feature would suggests peak speeds of between 400-450km/s are most likely to occur. The coronal hole is positive, which is not favored for a strong connection nor geomagnetic response close to the March equinox.

Geomagnetic activity is expected to be generally Quiet to Unsettled, with a chance of Active periods from Day 4 given the expected connection to the HSS of CH91/+. There is an associated very slight increase in the probability of a Minor Geomagnetic Storm/G1 interval for this same period. Probabilities may change for the latter part of the forecast period in subsequent issues of this briefing if the CME still to be assessed contains an Earth-directed CME.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	5	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections – Nil expected

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Radio Blackouts - X-Ray Flares:

Solar activity has been Low, with the largest flare in the past 24-hours a C3.9 event at 06/1400 UTC from AR3270 (Eso/Beta) in the far southwest. AR3272 (Esi/Beta) close to the southeast limb has been largely inactive during the same period, but previously produced an M3 flare on 06 Apr. The third sunspot on the visible disc is the small and magnetically simple AR3266 (Bxo/Beta) near the northwest limb.

AR3272 is now the largest and most complex region, with some intermediate spots now evident as the group rotates into clearer view in the far southeast. AR3270 has decayed somewhat, with the previously exhibited delta spot now having faded, as well as the intermediate spots. There has been some filament disruption in the vicinity of this region, and an increase in magnetic complexity again cannot be ruled out, although this region will rotate off of the visible disc on Day 4 (10 Apr). AR3266 will rotate off of the visible disc during Day 2 (08 Apr).

A bright region visible on STEREO-EUVI/195 imagery suggests that a new or returning region may emerge across the northeastern limb and onto the visible disc during Day 1 or 2 (07 or 08 Apr).

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	25	25	25	25
Very Active	R3 to R5 X Class	No	3	3	3	3

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Solar Radiation Storms - (High Energy Protons):

High energy proton flux (greater than 10MeV), as observed by GOES-16, is most likely to remain at Background levels pending any significant sunspot development. There is an very slight chance of protons reaching the S1 level, either from AR3270 which is in a favorable position to connect with Earth should a larger flare occur. AR2372, the region towards the southeast limb is unlikely to give a proton response at Earth from its current location during this period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	3	3	3	3
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2 MeV) is forecast to diurnally oscillate between Background and Moderate to High levels through much of the forecast period. Any connection to the HSS of CH91/+ on Day 4 (10 Apr) is likely to see electron counts fall, owing to increased Geomagnetic activity and suppression of the Van Allen electron belts.

Electron fluence has been at the Active threshold, but is likely to fall below this on Day 1 (07 Apr) as the electron belts assume a more steady state. Subsequent days are expected to bring a lower risk of the Active threshold being reached.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	Yes	100	40	20	10
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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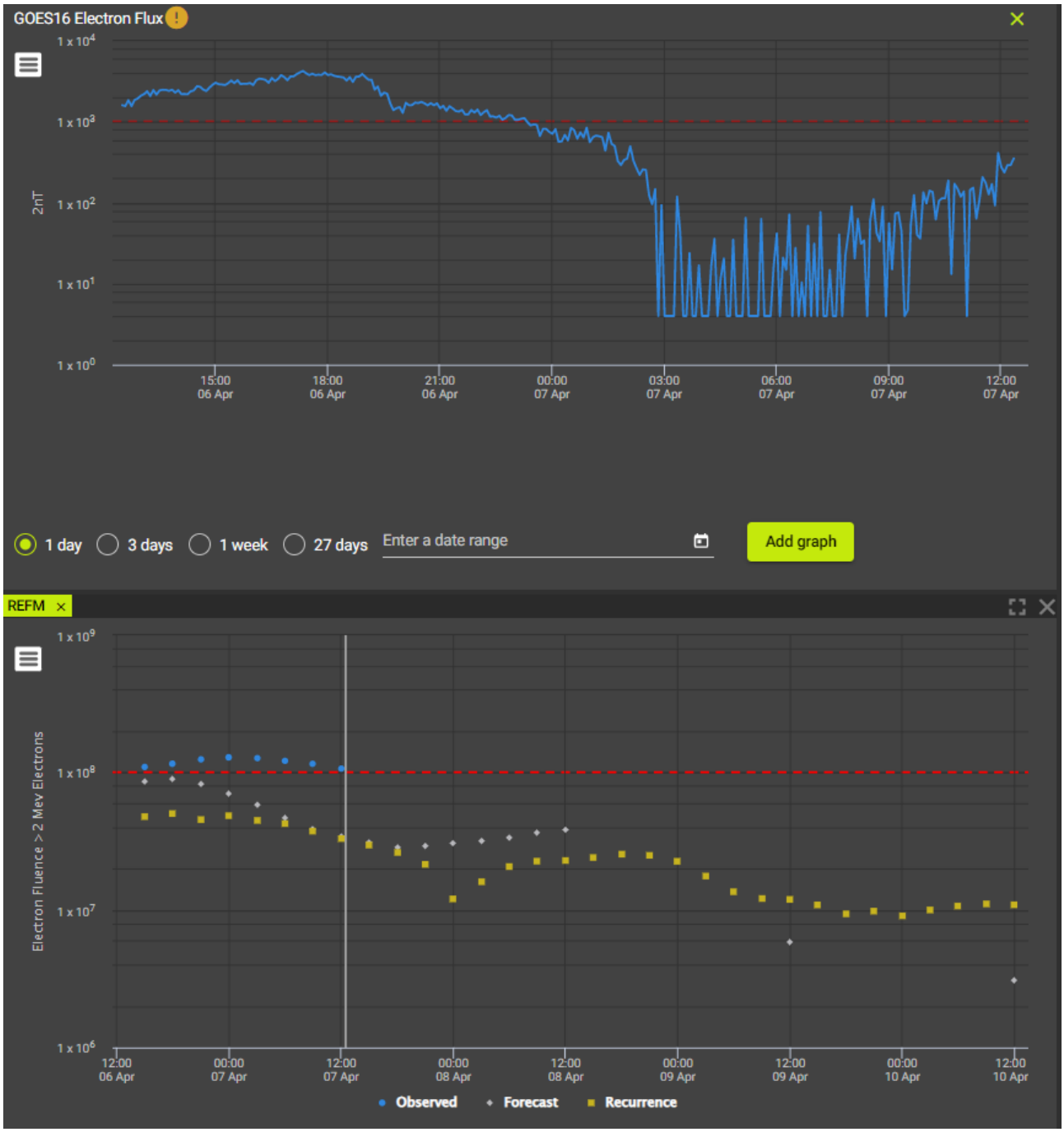
Figure 2: Latest GOES-16 Electron flux (above) and MOSWOC REFM forecast (below)



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